THE STONEFLY GENUS *MEGALEUCTRA* (PLECOPTERA: LEUCTRIDAE) NEW TO EAST PALEARCTIC REGION, WITH DESCRIPTION OF *MEGALEUCTRA SAEBAT* NEW SPECIES[1]

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ABSTRACT: The stonefly genus *Megaleuctra* (Plecoptera: Leuctridae), previously known in North America and from the Baltic Amber, is discovered from the East Palearctic region. Description of a new species, *Megaleuctra saebat* n. sp., and discussion on the distribution are provided.

The leuctrid (Leuctridae) stonefly genus *Megaleuctra* Neave is rare but relatively well known because of their relatively large body size (about 15mm in both adults and nymphs) among the members of the family. The adult of the genus can be easily distinguished by the possession of six anal veins in the hindwings. Other adult characteristics such as complicated male terminalia, which contain projections and titillators on the ninth tergite, and elongated female subgenital plate may also distinguish this genus from other genera of the family. The nymphal body of the genus is short and robust and resembles the nemourid-like body plan in general, but it can be distinguished by the hind wingpads being parallel to the body axis. The nymphs are generally found in headwater streams and seepage areas but they often survive in wet habitats of stream sides with damp stones and plentiful detritus (Stewart and Stark, 1988).

According to available distributional data of the genus (Illies, 1967; Baumann, 1973; Baumann et al., 1977; Stewart and Stark, 1988), all the extant species of the genus are in the Nearctic (Fig. 1). Four species, *Megaleuctra stigmata* (Banks, 1900), *M. complicata* (Claassen, 1937), *M. kincaidi* (Frison, 1942), and *M. sierra* (Fields, 1977), are known in western North America along the Rocky Mountains and other two species, *M. williamsae* (Hanson, 1941) and *M. flinti* (Baumann, 1973), are known in eastern North America along the Appalachian Mountains. In addition to these extant species, a fossil species, *M. jewetti* (Lewis, 1969), is recorded from the Latah formation of eastern Washington and northern Idaho in the Miocene and the only representative of the genus in the Palearctic region is the fossil species, *M. neavei* (Ricker, 1935), which is known from the Baltic Amber in Prussia in the Lower Oligocene (Fig. 1).

From our recent investigations, we recognize a new species of the genus from Korea, which represents the first known records of the genus to the East Palearctic region. We herein describe the species with discussions on the distribution of the genus.

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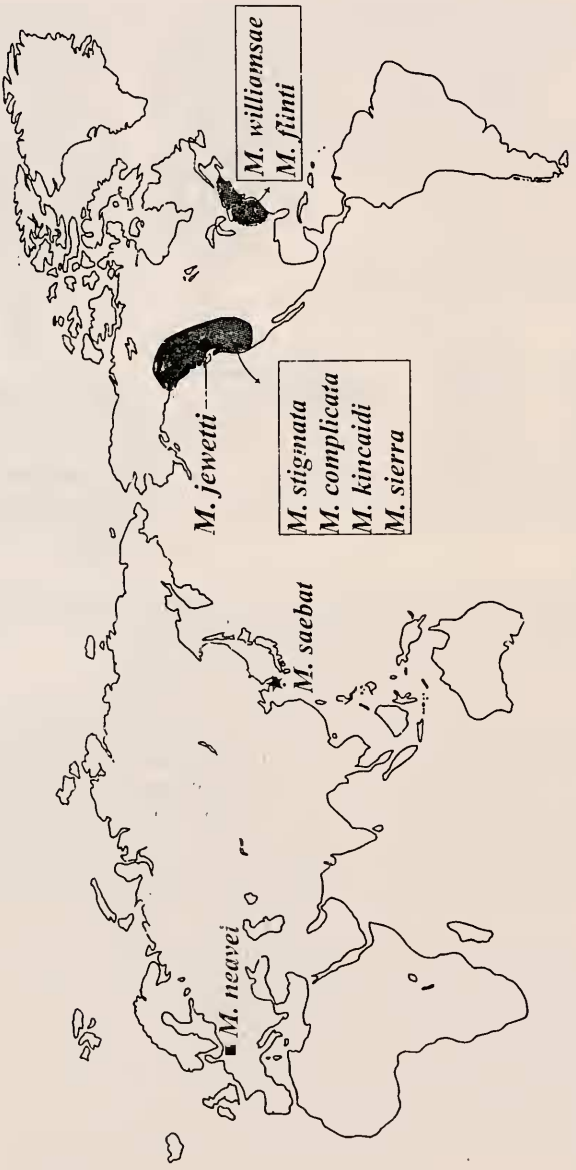
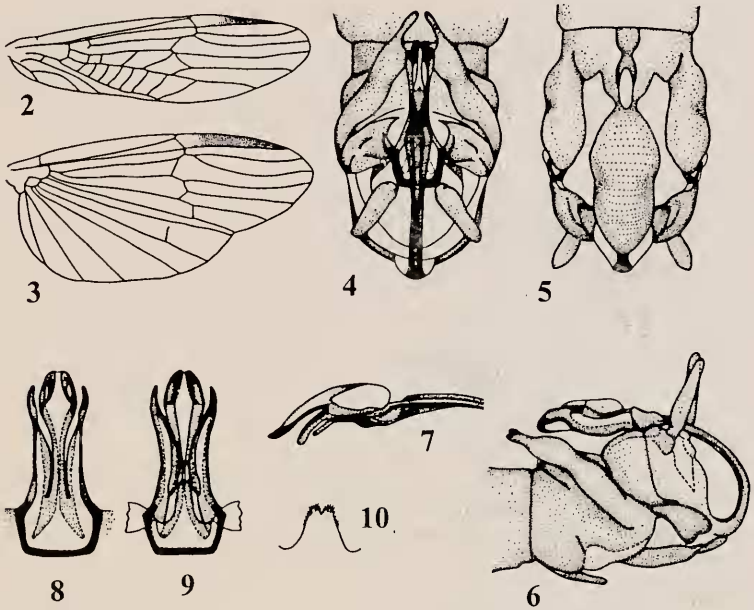


Fig. 1. Distribution of *Megaleuctra* spp.



Figs. 2-10. Male adult of *Megaleuctra saebat* n. sp.: 2. right forewing. 3. right hindwing. 4. dorsal terminalia. 5. ventral terminalia. 6. lateral terminalia. 7. lateral supra-anal process. 8. dorsal subanal lobe. 9. vental subanal lobe. 10. ventrobasal expansion on subanal lobe.

Megaleuctra saebat NEW SPECIES

(Figs. 2-14)

Male adult. Macropterous. Length of body 12mm; antennae 8mm; forewings 11mm; hindwings 9mm. General body color dark brown with blackish brown markings at coxa, junction between femur and tibia, and apex of tarsus. Head dark brown and as wide as prothorax. Antennae brown and as long as body. Pronotum wider than long. Wings hyaline, with dark patch in apicocostal area; forewings Rs and M arising separately from R (Fig. 2); hindwings with 6 anal veins (Fig. 3). Abdomen entirely brown; abdominal segment I-VIII unmodified; tergite IX apically bifurcate and forming paired projections toward tergite VIII (Fig. 4); subgenital plate large and covering base of subanal probe, basally constricted, and with median vesicle (Figs. 5 and 6); segment X highly modified: supra-anal process weakly sclerotized, trifurcate near base, and apically modified as in Fig. 7; subanal lobe elongated, tightly running with supra-anal process, basally broad and trifurcate near base, marginally strongly sclerotized and medially hyaline and membranous (Figs. 8 and 9), and with ventrobasal expansion (ventrobasal expansion weakly sclerotized, apically concave, and with apical setae) (Figs. 9 and 10). Cerci 1-segmented and relatively long.

Female adult. Macropterous. Length of body 13mm; antennae 10mm; forewings 11mm; hindwings 9mm. General morphology similar to male. Pronotum longer than wide. Abdominal tergite I-VIII with large light brown round marking medially and with small paired dark brown spots anteromedially (Fig. 11); tergite IX with light brown median stripe and with small paired dark brown spots anteromedially (Fig. 11); tergite X with paired dark brown spots sublaterally (Figs. 11 and 12). Abdominal sternite VIII subgenital plate greatly elongated above terminal abdomen (posterior portion above tergite VIII ca. 2.8x length of anterior portion), attenuating, and rolled downward

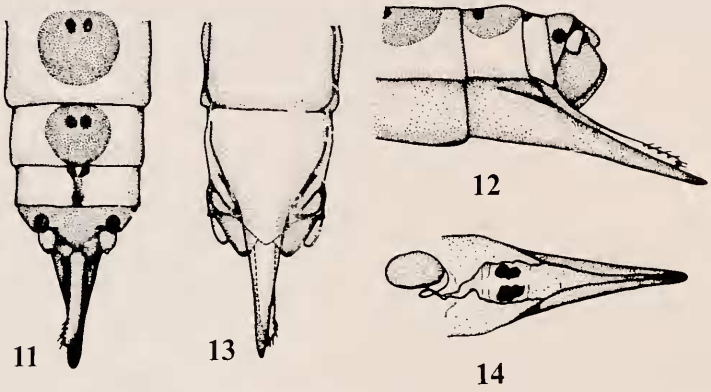


Fig. 11-14. Female adult of *Megaleuctra saebat* n. sp.: 11. dorsal terminalia. 12. lateral terminalia. 13. ventral terminalia. 14. subgenital plate (dissected).

(Figs. 12-14); sternite IX forming apically setose elongated structure extending nearly to terminus of subgenital plate (Figs. 11-13). Ovary oval; vagina wrinkled (Fig. 14). Cerci 1-segmented, relatively short and conical (Figs. 11-12).

Nymph. Unknown.

Diagnosis. The adult of *M. saebat* n. sp. can be easily distinguished from other species of the genus by the structure of terminalia (Figs. 4-14). The male adult of *M. saebat* is similar to that of *M. kincaidi* Frison in the structure of terminalia (Baumann et al., 1977), but differs by the following aspects: longer paired projections in tergite IX (Figs. 4 and 6), longer subanal lobe (Figs. 8-10), and longer, more strongly sclerotized, and more complicated supra-anal process (Figs. 4 and 7). The female adult of *M. saebat* has a much longer subgenital plate (Figs. 11-13) than that of *M. kincaidi*. The female adult of *M. saebat* is also similar to *M. stigmata* (Banks) as it has an elongated subgenital plate (Baumann et al., 1977), but it can be easily distinguished by the abdominal markings (Fig. 11) (*M. stigmata* lacks abdominal markings).

Material examined. Holotype: Male adult (in alcohol), Korea, Jeollabuk-do, Namwon, Jirisan (Mt.) at Seseokpyeongjeon (alt. 1600m), 5-VI-1983, S. Uchida, deposited at Seoul Women's University (SWU). Paratypes: 1 male and 2 female adults, same data and deposition as holotype. Other materials: 1 female adult, Korea, Chungcheongnam-do, Gongju, Gyeryongsan (Mt.) at Eunseonpokpo (waterfall) (alt. 400m), 10-V-1998, S. A. Ham (SWU); 1 female adult, Korea, Gangwon-do, Wonju, Chiaksan (Mt.) at Sangwonsa valley (alt. 800m), 25-V-2000, Y. H. Jin (SWU).

Etymology. The trivial name, *saebat* (noun), is a combination of old Korean words, *sae* (Eastern) and *bat* (Land), meaning "Land of East" that refers to the East Palearctic distribution of the species.

Distribution. Korea.

Habitat. Adults of *M. saebat* were collected from the headwater stream sides in high mountain areas ranging 400m ~ 1600m in altitude. The streams were steep and rapid and about 30cm to 2m wide; the substrate consists of mainly cobbles and boulders and abundant fallen leaves. The streams were completely to half-canopied by deciduous trees such as oaks and maples. The adults occurred from mid-May to early June.

DISCUSSION

The genus *Megaleuctra* has been known as a Nearctic relict, since all of the extant species and a fossil species were recorded from North America. The fossil species, *M. neavei*, known from the Baltic amber in the Oligocene (Ricker, 1935) was the only Palearctic representative of the genus. From our finding of *M. saebat* from Korea, the distribution of the genus *Megaleuctra* extends to the East Palearctic region.

Based on currently known distributional data of the genus (Fig. 1), it is hypothesized that the ancestral megaleuctrids distributed throughout the Holarctic continents at least up to the Lower Oligocene. The present disjunct pattern in the species groups in western and eastern North America and Northeast Asia is probably due to their habitat and behavioral adaptation. Larvae of the genus are limited to the headwater streams, seeps or springs of high mountain areas (Baumann, 1973; Stewart and Stark, 1988) and adults of the genus are poor dispersers as are other stonefly adults. This disjunct distributional pattern in Holarctic continents is also known in many aquatic insect groups such as Pteronarcyidae (Plecoptera) (Nelson, 1988), Potamanthidae (Ephemeroptera) (Bae and McCafferty, 1991), and Neoephemeridae (Ephemeroptera) (Bae and McCafferty, 1998).

Among the aquatic insects cohabited with *M. sabat* in Korean streams, the wingless stonefly family Scopuridae, *Scopura* spp., showed similar habitat adaptation. All the members of the Scopuridae, that are geographically limited to the Korean Peninsula and the Japanese Islands, are also limited to the headwater streams (Uchida and Maruyama, 1987).

The extinction of *M. neavei* in Europe is most probably due to the glacial events in the Cenozoic era whereas the North American species have possibly survived along the north-south oriented mountain ranges that may have acted as refugia (Cox and Moore, 1985). Despite long-time intensive taxonomic studies of the Plecoptera in Japan (Kawai, 1985) and Russian Far East (Zhiltzova and Zapekina-Dulkejt, 1986), the genus has not been found in Northeast Asia except for our finding of *M. saebat* from Korea.

An examination of external morphology of *M. saebat* indicates a close affinity between *M. saebat* and *M. stigmata*-group, the western Nearctic group, based on shared similarities in male and female terminalia as well as in general morphology (see Diagnosis above). This may indicate a possible connection between *M. saebat* and *M. stigmata*-group through Beringia during the

ice age in the Cenozoic era. Further investigations of the distribution as well as morphological and phylogenetic analyses may enhance the knowledge of the evolution and biogeography of the genus.

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